



The **7** Market Obstacles to Daylighting

A number of factors have dimmed daylighting's prospects. But there may be some light on the horizon, a new industry report by Eneref Institute finds

BY SETH WARREN ROSE

You don't need a degree in illuminating engineering to know that a room with a view, one with windows that lets natural light in, is what we desire. Inherently, we just know. Yet, despite formidable efforts by a few daylighting professionals—many of whom were interviewed for this report—daylight harvesting's adoption remains darkened by building owners' skepticism and clouded by architects' incertitude.

Few technologies offer the level of both human and environmental benefits that daylighting does, yet its market share remains only a sliver of what it could be. Better lighting ideas are not always easy to sell. Europe is ahead of the U.S. (Germany's building codes bring window light within 10 meters of workspace), but Europe too could improve.

"You go back to older architecture, and those architects used daylighting in and out," asserts Nancy Clanton, founder and president of Clanton & Associates and a leading advocate for sustainable design. "Now, our buildings aren't working. And people aren't happy with them."

Through interviews and research, Eneref Institute has uncovered some of the reasons—seven in total, ranging from the technological to the financial—why day-

lighting has struggled to break through in commercial environments, and how these hurdles to acceptance can be overcome in the coming years.

1 PROFIT—FOLLOW THE MONEY

Daylighting is a relatively small segment of the lighting industry, with combined revenues of the leading U.S. skylight manufacturing sales adding up to perhaps \$200 million per year, according to Jacque Stevens, senior business development manager for Sunoptics Acuity Brands. The daylighting industry has the potential to grow exponentially if fully understood and appreciated by architects, facility owners and the public, according to most daylighting industry advocates. That daylighting represents such a small piece of the lighting market offers an opportunity for growth, but also may be the limiting factor: the profit motive and marketing machine behind electric luminaires is stronger and easier to quantify. And like other renewable technologies, daylighting suffers from the owner-tenant riddle, whereby the facility owner invests but the tenant benefits.

2 SILOS—CULTURAL INERTIA

"Fundamentally, I think the basic problem is cultural; we need to get many more types of professionals to embrace responsibility for daylight's [potential] impact," says Lisa Heschong, managing principal of the Heschong Mahone Group, Inc., and coauthor of the industry's leading studies on the human benefits of daylighting.

Many daylighting professionals fault designers, engineers and contractors, who do not fully understand how daylighting integrates, not just with lighting, but with the building envelope. Lighting designers and

interior designers, especially, need to collaborate both to avoid blocking the sun and also to take full advantage of it.

Ed Blair, vice president and general manager of Lutron, believes designers should promote the societal benefits of daylighting. "As society's focus has shifted to worker performance and productivity, there is an increased sensitivity to all environmental factors including dramatic changes in brightness and contrast provided by daylight," Blair maintains. "To achieve satisfaction in such dynamic environments, designers and owners will need to embrace dynamic solutions to optimize both occupant comfort and energy performance."

The illuminating community, from manufacturers to designers, perceives spaces differently than photobiologists who have a keen understanding of how light affects biology. Neither research nor terminology is synchronized. It needs to be. "There's a physiological appetite for light and dark," says PNNL senior lighting engineer Naomi Miller, who is concerned about the trend to bring light levels down too low without "gobs of good quality daylight coming into the building." Low ambient light levels "could be problematic for populations who drive to work in the dark and then leave in the dark at the end of the day," says Miller.

According to James Benya, principal of the Benya Burnett Consultancy, designing lighting for the maintenance of human circadian systems and using "as much daylighting as possible" are keys to "building occupants' wellness and productivity."

But some lighting designers "generally don't trust daylight and don't often know how to think about variable environments," says Heschong.

3 PERCEPTION—MAKING THE RIGHT IMPRESSION

The report identifies more education as the solution, and in particular, more guidance for architects. "Probably the biggest hurdle for the daylighting industry is educating the public on what quality daylighting is and how can we apply it easily to nearly any project," says Neall Digert, vice president of product enterprise at Solatube International, Inc.

Yet, the industry is challenged with obtaining credible data to substantiate its advantages. Fortunately, the results of significant and often-cited studies by HMG (www.h-m-g.com) demonstrate the positive human benefits of good daylighting design.

Daylighting costs are exacerbated by its uniqueness: architects often reinvent the wheel with each project. While their buildings may present splendid demonstrations of daylighting's potential, those same concepts may not apply to buildings whose owners lack the vision and budget. However, Heschong evaluates budgeting differently. "Poor ROI is a function of poor design optimization. Using ROI can be a lazy excuse for not finding a better solution."

Retrofit projects are driven by payback calculations, and too many companies focus on a simple two-year payback. Financial officers are often rooted in the mindset of ballast and lamp replacement or added reflectors. But skylights and tubular devices do not replace, but rather augment, the electric lighting. According to Chip Israel, president of the Lighting Design Alliance and IES past-president, daylighting needs to be sold on lifecycle cost, such as how retail sales, school test scores and worker productivity "go up" with daylighting integration. "Those

things outweigh the cost of energy, even at the current or future costs,” says Israel.

In addition, many architects seem reluctant to choose readily-available, low-cost off-the-shelf daylighting solutions (such as exterior shades or vertical fins) to avoid look-alike aesthetics. “We find that a lot of the architects would prefer to design something that’s more integral to the architecture and more part of the design aesthetic,” explains Jake Wayne, a senior consultant and PE with Arup.

Of course for new facilities, design-build includes the cost of daylighting in the cost of the building, easing the decision for financial officers. However, sometimes the final decision-makers in the sales process remain unconvinced of the benefits. “When it’s time for the decision

between multiple components from different vendors. Grant Grable, global vice president with Acuity Brands, adds that “Daylighting is not an out-of-a-box solution. Building operators and owners just need an easier way to be able to implement the solution.”

Skylights, in particular, have a reputation for water leaks, although when properly installed are unlikely to malfunction. In fact, condensation is often misinterpreted as evidence of a leak. Clanton notes that when building owners express concerns about leaks, they fail to realize that “you already make holes in the roofs for air handlers and exhaust systems.”

Still, even the simplest system can fail if poorly implemented—for example, if control/contrast ratios within the space

4 AUTHORITY—WHO’S IN CHARGE?

The sun causes extreme glare, sometimes reflecting off a building, a car windshield or puddle; it’s unpredictable. Poorly implemented daylighting will shift light patterns and greatly vary contrast ratios, burdening the electrical design to overcome the problems.

Rob Guglielmetti, lighting simulationist with National Renewable Energy Laboratory (NREL), is confident that properly implemented daylighting offers great opportunities. “If we can harness the sun through specular reflectors or daylight redirection devices, we can do a really good job of daylighting a space without glare and with almost no impact on cooling energy, if done correctly.”

Lutron’s Blair agrees that the opportu-

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to pull the trigger, the CFO says, ‘Gosh, it’s great but I’m just not sure we are going to see [the benefit],’” says Digert.

And some facility owners are concerned about maintenance costs. Controls for active shading systems with sensors or external motorized louvers can seem complex and prone to maintenance problems. The more complex the system, the more reluctant a risk-averse facility owner is to specify it.

Whole Foods Market’s Mike Ellinger says the company “tried a lot of options” including solar tracking skylights. “It’s a big deal, but either it’s definitely done right, or it just doesn’t work for you,” he says.

Daylighting can be especially complex when the system requires interaction

are not well understood. Stories of occupants covering windows with cardboard to block out the sun have hurt the industry. Today, however, this is less likely, explains Kevin Leadford, vice president, innovation, for Acuity Brands. “We now have the understanding and analytical tools to do a better job of daylighting. It’s just a bit more involved and requires the oversight of seasoned professionals.”

While most said the perception problems were likely the result of poor execution, James Satterwhite, vice president sales and marketing for Wasco, insists poor quality products have been equally culpable. Either way, building owners have long memories.

nity for daylighting is enormous. “There are thousands of existing buildings waiting for the right daylight management systems to take advantage of the abundant natural light,” says Blair. “To meet the needs of these buildings, retrofit solutions without major building modifications are key, even if these solutions are somewhat less daylight optimized.”

In commercial buildings, daylighting decisions are often controlled by engineers, not lighting professionals. Architects forfeit window specs to HVAC engineers who determine solar heat gain coefficient. Engineers are comfortable running the numbers and architects let them. The problem is that HVAC engineers are taught to design for worst-case

conditions and regard daylighting as a thermal challenge rather than a lighting or human performance challenge. But good lighting design mitigates heat gain, says Clanton, with mechanisms like sophisticated glazing or shading to minimize direct sun penetration.

Lighting designers are the experts and know how to create the best possible visual environment, according to Heschong. They should “take ownership of it,” she argues. This is true not just in the U.S., but also in Europe, “where 95 percent of daylighting design is done by HVAC engineers,” says Andreas Danler, a lighting designer with Bartenbach Lichtlabor GmbH of Austria. However, according to Danler, possibilities abound outside conventional thinking (e.g., reflecting daylight into spaces deep underground). Bartenbach also envisions entirely new opportunities for reflecting light outdoors, like increasing light levels to the bottom of Europe’s century-old courtyards “by a factor of five,” says Danler.

According to Frank Schoonen, sales and marketing director with German-based Alanod Aluminum, a manufacturer of reflective materials, “Bartenbach’s designs for reflecting daylight is interesting for Europe,” said Schoonen. “They are even designing light shafts from buildings only 50 meters apart.”

PRICE—WRONG PAYBACK CALCULATORS

As with most lighting systems, daylighting bumps up against price points, and good systems are substituted with lower-cost, less optically enhanced technologies. Understandably, facility owners

calculate for lost opportunity costs. Although, as Tim Hogan, vice president, education market at Acuity Brands, points out, “The kinds of holistically better facilities that you get through more rigorous standards, such as LEED, CHPs and Energy Star, actually cost less in money, energy and resources in the long run.”

Still, the reason cost is a deterrent to sales is that payback is not simple to quantify for building owners. Corporate executives generally want an ROI of at least 20 percent. Consumers want a payback of three years or less.

Skylights or tubular devices offer a faster payback when artificial lights can be shut off. However, light shelf or vertical blinds to reduce glare have a longer payback. The calculation often depends on the objective: reduced energy vs. meeting codes, for example.

Poorly implemented and designed control systems will deteriorate the financial benefits, according to Lutron’s Blair. “What has become apparent, based on recent studies on the performance of daylight harvesting systems, is that achieving energy savings from daylighting requires proper startup and commissioning of the control system from a knowledgeable and experienced service organization,” says Blair. “Without this, it is highly unlikely that significant energy savings will be achieved.”

The solar market is driven by government and utility incentives, which shorten payback time, and more incentives for daylighting could help. However, programs with complex rules increase transaction costs, and daylighting may be prone to such complexities.

COMPETITION—RENEWABLE’S CROWDED FIELD

Lighting is not the only option for energy managers looking to save. Especially for buildings with nighttime operations, technologies that reduce energy use without sunlight offer an economic advantage over daylighting. A building owner only has so many dollars to spend.

Daylighting competes with other lighting technologies as well, especially with LEDs. But as Heschong is quick to point out, “Daylighting systems will always save you half of the lighting energy regardless of how efficient it is; you can always turn it off half the time.”

Photovoltaic panels compete for the same real estate on the building, and if PV is meeting a code requirement, daylighting will lose. PV has numerous incentive programs as well as sophisticated financing opportunities for building owners. Redefining daylighting as “solar” or “renewable” could help, because daylighting offers substantially more energy than PV for the same amount of roof space.

METRICS—GETTING THEM RIGHT

“We are constantly fighting with archaic code requirements,” says Solatube’s Digert. Daylighting codes should maximize transmittance potential first and minimize solar heat gain second, insists Digert. That change is now taking shape as newly created metrics are set to improve the prospects for daylighting in the coming years. Until recently, the industry didn’t have acceptable metrics for daylighting levels. But with the new IES LM-83-12 and LEED v4, that’s changing.

Designers are taught to light a space for

an optimal static condition, such as 40 footcandles throughout the space. Daylighting metrics are more complicated because they examine a range of visible light transmittances for a wide spread of solar altitudes and angles. In short, daylighting requires a prediction.

Led by Heschong as committee chair, IES LM-83-12 offers two new metrics that should help to increase market penetration for daylighting: Spatial Daylight Autonomy (sDA) gauges annual illumination levels and Annual Sunlight Exposure (ASE) measures the risk for sunlight glare.

Meanwhile, Clanton and others were instrumental in bringing significant improvements to daylighting credits in LEED

v4, designed to better connect building occupants with the outdoors, and also incorporate the recent innovations in daylight modeling.

And today new modeling software tools support dynamic daylighting, and will greatly change how daylighting's benefits can be substantiated.

THE AUTHOR

Seth Warren Rose is the founding director of Eneref Institute (www.eneref.org), a research and advocacy organization for sustainable development. This report, along with a series of daylighting case studies, is part of an Eneref Institute initiative to raise awareness and uncover new opportunities in responsible use of waste, water and energy.

Cities Step Up

Traditionally, the marketing of daylighting involves educating architects and facility owners. However, a growing yet untapped market is the increasing number of municipalities and organizations who have brought on sustainability officers. They naturally view improved lighting design as an investment both in occupants' health as well as in energy savings. "A five year payback is completely arbitrary for a city government," explains Tom Perrigo, chief sustainability officer for the City of Las Vegas, who recently helped specify new streetlights for the entire city. "It's like asking what's the payback on building a park, or filling a pothole? There are other community benefits for investing in public facilities."

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